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(54) **Mobile bearing knee with metal on metal interface**

Knieprothese mit beweglichem Einsatz und Metall-Metall Kontaktfläche

Genou à insert mobile avec interface métal-métal

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(56) References cited:
WO-A-97/30664
FR-A- 2 663 536
FR-A- 2 755 004
US-A- 5 064 437
US-A- 5 395 401

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Description

Field of the Invention

[0001] This invention relates to a prosthetic knee implant of the type commonly referred to as a mobile bearing knee and has specific relevance to a mobile bearing knee implant having a metal or ceramic backed articulating component which contacts a metal or ceramic tibial component.

Summary of the Invention

[0002] Prosthetic knee implants having a tibial articulating surface which is moveable relative to a fixed tibial tray during flexion and extension of the knee joint are known as mobile bearing knees and will be referred to as such throughout this description. Heretofore, mobile bearing knees primarily consist of a tibial component affixed to the prepared proximal end of a tibia and a bearing component made from polyethylene, typically ultra high molecular weight polyethylene (UHMWPE). Generally, there exists some mechanism or a plurality of mechanisms to restrict or limit the movement of the shiftable articulating component relative to the tibial component during movement of the knee. WO-A-97/30664 describes a typical mobile bearing knee of this type. US-A-5395 401 describes a mobile bearing knee of complicated construction providing room rotational and anterior - posterior motion. Similarly FR-A-2 663 536 discloses a mobile bearing knee having several separate pieces in order to provide mobility. A femoral component replacing a portion of the distal femur and configured to articulate against the articulating component is also required for a complete prosthetic knee joint; however, for the purpose of this application, the particular design of the femoral component or any detail thereof is considered irrelevant.

[0003] In the subject invention, the articulating component includes a metal tray and a polyethylene bearing molded, or otherwise connected, to the metal tray. The distal surface of the metal tray, the surface in contact with the tibial component, is highly polished and is substantially flat. The proximal surface of the tibial component, the surface in contact with the articulating component, is likewise highly polished and substantially flat. In use, the two highly polished flat surfaces provide an environment wherein the articulating surface may freely move relative to the tibial component as the patient's knee joint is flexed and extended during movement. In the preferred embodiment, the tibial component includes a hollow frusto-conical projection which extends into the tibial bone. Further, the metal tray of the articulating component includes a frusto-conical projection configured to extend into the frusto-conical projection of the tibial component. The inner dimension of the projection of the tibial tray is greater than the outer dimension of the projection of the metal tray and may be adjusted during manufacturing such that the metal tray, and thereby the articulating surface, is restricted or limited to a specific range of movement relative to the tibial component.

[0004] Alternatively, the metal tray and/or tibial component could be made in whole or in part from an ceramic material as is commonly used in the field of orthopaedics.

[0005] Accordingly, it is an object of the invention to provide for a novel mobile bearing knee having an articulating component formed with a metal tray for contact against the tibial component.

[0006] Another object of this invention is to provide for a novel mobile bearing knee having an articulating component formed with a metal tray for contact against the tibial component, wherein an articulating surface is connected to the metal tray for contact with a femoral component.

[0007] Yet another object of the invention is to provide a novel mobile bearing knee having an articulating component formed with a ceramic tray for contact against the tibial component.

[0008] Other objects of the invention will become apparent upon a reading of the following description taken with the accompanying drawings.

BriefDescription of the Drawings.

[0009]

Figure 1 is a sectional view of the mobile bearing knee of the invention which includes a tibial component and the articulating component and is attached to a proximal end of a prepared tibia.

Figure 2 is a top down view of the tibial component of the mobile bearing knee of the invention.

Figure 3 is a side elevational view of the tibial component of Fig. 2.

Figure 4 is a sectional view taken along line 4-4 in Fig. 2.

Figure 5 is a top down view of the metal tray portion of the articulating component of the invention.

Figure 6 is a side elevational view thereof

Figure 7 is a elevational view taken along line 7-7 of Fig. 6.

Description of the Preferred Embodiment

[0010] The preferred embodiments herein described are not intended to be exhaustive or to limit the application to the precise forms disclosed. Rather, they are chosen and described in order to explain the invention to those skilled in the art in order that they may utilize its teachings.

[0011] Referring now to the figures, a mobile bearing knee 10 is illustrated in sectional view connected to the proximal end of a prepared tibia 8 (also shown sectioned). Mobile bearing knee 10 includes a tibial com-

ponent 12 and an articulating component 14.

[0012] Tibial component 12 is formed from a known bio-compatible metal such as titanium or cobalt-chromium and is configured for contact on its distal face 16 with the tibia 8 and on its proximal face 18 with articulating component 14. The outer periphery of the tibial component is generally ovoid in shape. In the preferred embodiment, the tibial component 12 includes a hollow frusta-conical projection 20 extending from its proximal face 18 through and continuing away from distal face 16. Tibial component 12 is intended to be securely fixed to tibia 8 in a known manner, such as by screws (not shown) or by a layer of bone cement (also not shown) or by a press fit between the bone and tibial component. The particular method of securing the tibial component 12 to the tibia is one of design choice and unimportant to the subject invention. Further, in the preferred embodiment, the proximal face 18 of the tibial component is highly polished and substantially flat.

[0013] Articulating component 14 includes a metal tray 24 and a polymer articulating plate 26. The outer periphery of the articulating component 14 is substantially ovoid and is intended to substantially match the outer periphery of the tibial component 12, however, such should not be considered a limitation on the invention. Metal tray 24 is formed from a known bio-compatible metal such as titanium or cobalt-chromium and includes a plate portion 28 having a proximal surface 30 and a distal surface 32. A frusta-conical projection 33 extends away from distal surface 32. In the preferred embodiment, the distal surface of plate portion 28 is highly polished and substantially flat. The proximal surface includes a plurality of rails 34 which, in the preferred embodiment, have a generally T-shaped cross section. A pair of inverted L-shaped side rails 36 extend upwardly from the proximal surface 30 and define the lateral boundaries for the plate. The articulating plate 26 is formed having an articulating surface 38 configured for contact with the condylar portions of a femoral knee implant (not shown) in a known manner. The articulating plate may be molded directly to the metal tray 24 in the manufacturing environment. Alternatively, the proximal surface of the metal tray may be modified in keeping with known methods to allow the articulating plate 26 to be snapped onto the metal tray 24. Whether the articulating plate 26 is molded or snap fitted onto the metal tray 24 is not pertinent to the invention and may be modified within the keeping of the invention by one skilled in the art.

[0014] In use, the proximal surface of the tibial is prepared to accept the tibial tray 12 and the tibial tray is connected or otherwise securely fixed to the proximal tibia in a known manner. Next, the articulating component 14 is placed onto the tibial component 12 so the projection 33 from the articulating component 14 resides within the hollow projection 20 of the tibial tray. The outer dimension of projection 33 is slightly smaller than the inner dimension of the projection 20 such that projection 33 is able to move within projection 20 a limited amount. In this manner, the designer of the mobile bearing knee 10 can provide for a proper amount of movement of the articulating component 14 relative to the tibial tray 12. The exact amount of such movement or the difference between the inner dimension of projection 20 and the outer dimension of projection 33, at this point, is one of mere design choice. Since the proximal surface 18 of the tibial component 12 and the distal face 32 of the articulating component 14 are formed from metal and are highly polished and flat, during flexion and extension of the knee joint, the articulating surface may shift relative to the tibial component limited only by the contact between the inner dimension of projection 20 and the outer dimension of projection 33. It is anticipated that natural body fluids near the joint will act as a lubricant between the tibial component and the articulating component.

[0015] It should be understood that a wide variety of mechanisms for limiting movement between the articulating component and the tibial component may be developed and the application should not be limited to the precise forms disclosed. For example, the tibial component could include a post extending proximally into the articulating component to serve as a means for limiting the relative movement between the two components. Further, the tibial component, or articulating component, could include a plurality of tabs that could extend either into slots in the other component or be positioned about the periphery and contact the periphery of the other component. Regardless of the particular mechanical means employed to limit movement between the two components, it is important that the proximal surface of the tibial component and the distal surface of the metal tray of the articulating component be substantially flat and highly polished.

[0016] It may be desirable to place a quantity of lubricating fluid such as synovial fluid in the gap formed between projection 33 and hollow projection 20 to aid in lubricating the mobile bearing knee and thereby reduce friction.

[0017] It should be understood that while the subject invention has been described as being formed from a metal or metal alloy, such should not be considered a limitation to the invention. The tibial component 12 and the tibial tray 14 could be formed from a bio-compatible ceramic material and still be in keeping with the invention.

[0018] It should also be understood that the invention is not to be limited to the precise forms disclosed, rather, it may be modified in keeping with the appended claims.

Claims

1. A mobile bearing knee (10) comprising a tibial component (12) having a distal surface (16) and a proximal surface (18), and an articulating component (14) having a distal surface (32) and a proximal sur-

face (30), wherein the distal surface (32) of the articulating component (14) is placed in sliding engagement with the proximal surface (18) of the tibial component (12), wherein the tibial component is metal and the knee (10) further includes a limiting means extending between the articulating component (14) and the tibial component (12) for limiting the sliding engagement between the articulating component (14) and the tibial component (12) to a predetermined range, **characterised in that** the limiting means include a hollow projection (20) extending through the proximal surface (18) and distal surface (16) of the tibial component (12) and away from the distal surface (16), the limiting means further including a projection (33) extending from the articulating component (14) into the hollow projection (22) of the tibial component (12), the hollow projection (33) of the tibial component (12) having an inner dimension and the projection (33) of the articulating component (14) having an outer dimension, wherein the inner dimension of the hollow projection (20) is larger than the outer dimension of the projection (33) from the articulating component (14) such that the projection (33) from the articulating component (14) is shiftable within the hollow projection (20) with the distal surface (32) of the articulating component (14) in sliding engagement with the proximal surface (18) of the tibial component (12).

2. The mobile bearing knee (10) of Claim 1 **characterised in that** the proximal surface (30) of the articulating component (14) is formed from a polyethylene material and is configured for contact with condylar bearing surfaces of a femoral prosthetic implant.

3. The mobile bearing knee (10) of Claim 1 **characterised in that** the tibial component (12) and the distal surface (32) of the articulating component (14) are formed from bio-compatible metal.

4. The mobile bearing knee (10) of Claim 3 **characterised in that** the proximal surface (18) of the tibial component (12) is substantially flat and is highly polished.

5. The mobile bearing knee (10) of Claim 4 **characterised in that** the distal surface (32) of the articulating component (14) is substantially flat and is highly polished.

6. The mobile bearing knee (10) of Claim 1 **characterised in that** the distal surface (32) of the articulating component (14) and the proximal surface (18) of the tibial component (12) are formed from a biocompatible ceramic.

Patentansprüche

1. Knieprothese mit beweglichem Lager (10), mit einer Tibiakomponente (12), die eine distale Fläche (16) und eine proximale Fläche (18) aufweist, und mit einer drehbeweglichen Komponente (14) mit einer distalen Fläche (32) und einer proximalen Fläche (30), wobei die distale Fläche (32) der drehbeweglichen Komponente (14) in Gleiteingriff mit der proximalen Fläche (18) der Tibiakomponente (12) angeordnet ist, wobei die Tibiakomponente aus Metall hergestellt ist und die Knieprothese (10) ferner eine sich zwischen der drehbeweglichen Komponente (14) und der Tibiakomponente (12) erstreckende Begrenzungseinrichtung zum Begrenzen des Gleiteingriffs zwischen der drehbeweglichen Komponente (14) und der Tibiakomponente (12) auf einen vorgegebenen Bereich aufweist, **dadurch gekennzeichnet, daß** die Begrenzungseinrichtung einen hohlen Vorsprung (20) aufweist, der sich durch die proximale Fläche (18) und die distale Fläche (16) der Tibiakomponente (12) und von der distalen Fläche (16) weg erstreckt, die Begrenzungseinrichtung (33) ferner einen sich von der drehbeweglichen Komponente (14) in den hohlen Vorsprung (22) der Tibiakomponente (12) erstreckenden Vorsprung (33) aufweist, der hohle Vorsprung (33) der Tibiakomponente (12) eine Innenabmessung und der Vorsprung (33) der drehbeweglichen Komponente (14) eine Außenabmessung aufweist, wobei die Innenabmessung des hohlen Vorsprungs (20) größer ist als die Außenabmessung des Vorsprungs (33) der drehbeweglichen Komponente (14), so daß der Vorsprung (33) der drehbeweglichen Komponente (14) innerhalb des hohlen Vorsprungs (20) verschiebbar ist, wobei die distale Fläche (32) der drehbeweglichen Komponente (14) mit der proximalen Fläche (18) der Tibiakomponente (12) in Gleiteingriff steht.

2. Knieprothese mit beweglichem Lager (10) nach Anspruch 1, **dadurch gekennzeichnet, daß** die proximale Fläche (30) der drehbeweglichen Komponente (14) aus einem Polyethylenmaterial hergestellt und für einen Kontakt mit den kondylären Lagerflächen eines femoralen prothetischen Implantats konfiguriert ist.

3. Knieprothese mit beweglichem Lager (10) nach Anspruch 1, **dadurch gekennzeichnet, daß** die Tibiakomponente (12) und die distale Fläche (32) der drehbeweglichen Komponente (14) aus einem biokompatiblen Metall hergestellt sind.

4. Knieprothese mit beweglichem Lager (10) nach Anspruch 3, **dadurch gekennzeichnet, daß** die proximale Fläche (18) der Tibiakomponente (12) im wesentlichen flach und hochglanzpoliert ist.

5. Knieprothese mit beweglichem Lager (10) nach Anspruch 4, **dadurch gekennzeichnet, daß** die distale Fläche (32) der drehbeweglichen Komponente (14) im wesentlichen flach und hochglanzpoliert ist.

6. Knieprothese mit beweglichem Lager (10) nach Anspruch 1, **dadurch gekennzeichnet, daß** die distale Fläche (32) der drehbeweglichen Komponente (14) und die proximale Fläche (18) der Tibiakomponente (12) aus einem biokompatiblen Keramikmaterial hergestellt sind.

Revendications

1. Genou à insert mobile (10) comprenant un composant tibial (12) possédant une face distale (16) et une face proximale (18), et un composant d'articulation (14) possédant une face distale (32) et une face proximale (30), dans lequel la face distale (32) du composant d'articulation (14) est placée en contact glissant avec la face proximale (18) du composant tibial (12), dans lequel le composant tibial est en métal, et le genou (10) comprend de plus un moyen de limitation s'étendant entre le composant d'articulation (14) et le composant tibial (12) afin de limiter le contact glissant entre le composant d'articulation (14) et le composant tibial (12) à une plage prédéterminée, **caractérisé en ce que** le moyen de limitation comprend une saillie creuse (20) s'étendant à travers la face proximale (18) et la face distale (16) du composant tibial (12), et dans le sens de l'éloignement par rapport à la face distale (16), le moyen de limitation comprenant de plus une saillie (33) s'étendant à partir du composant d'articulation (14) vers l'intérieur de la saillie creuse (20) du composant tibial (12), la saillie creuse (20) du composant tibial (12) possédant une dimension interne et la saillie (33) du composant d'articulation (14) possédant une dimension externe, dans lequel la dimension interne de la saillie creuse (20) est plus grande que la dimension externe de la saillie (33) partant du composant d'articulation (14), de telle sorte que la saillie (33) partant du composant d'articulation (14) peut bouger à l'intérieur de la saillie creuse (20), la face distale (32) du composant d'articulation (14) étant en contact glissant avec la face proximale (18) du composant tibial (12).

2. Genou à insert mobile (10) de la revendication 1 **caractérisé en ce que** la face proximale (30) du composant d'articulation (14) est formée à partir d'un matériau polyéthylène, et est configurée pour le contact avec les faces condyliennes portantes d'un implant prothétique fémoral.

3. Genou à insert mobile (10) de la revendication 1 **caractérisé en ce que** le composant tibial (12) et la face distale (32) du composant d'articulation (14) sont formés à partir d'un métal biocompatible.

4. Genou à insert mobile (10) de la revendication 3 **caractérisé en ce que** la face proximale (18) du composant tibial (12) est sensiblement plate, et est polie miroir.

5. Genou à insert mobile (10) de la revendication 4 **caractérisé en ce que** la face distale (32) du composant d'articulation (14) est sensiblement plate, et est polie miroir.

6. Genou à insert mobile (10) de la revendication 1 **caractérisé en ce que** la face distale (32) du composant d'articulation (14) et la face proximale (18) du composant tibial (12) sont formées à partir d'une céramique biocompatible.

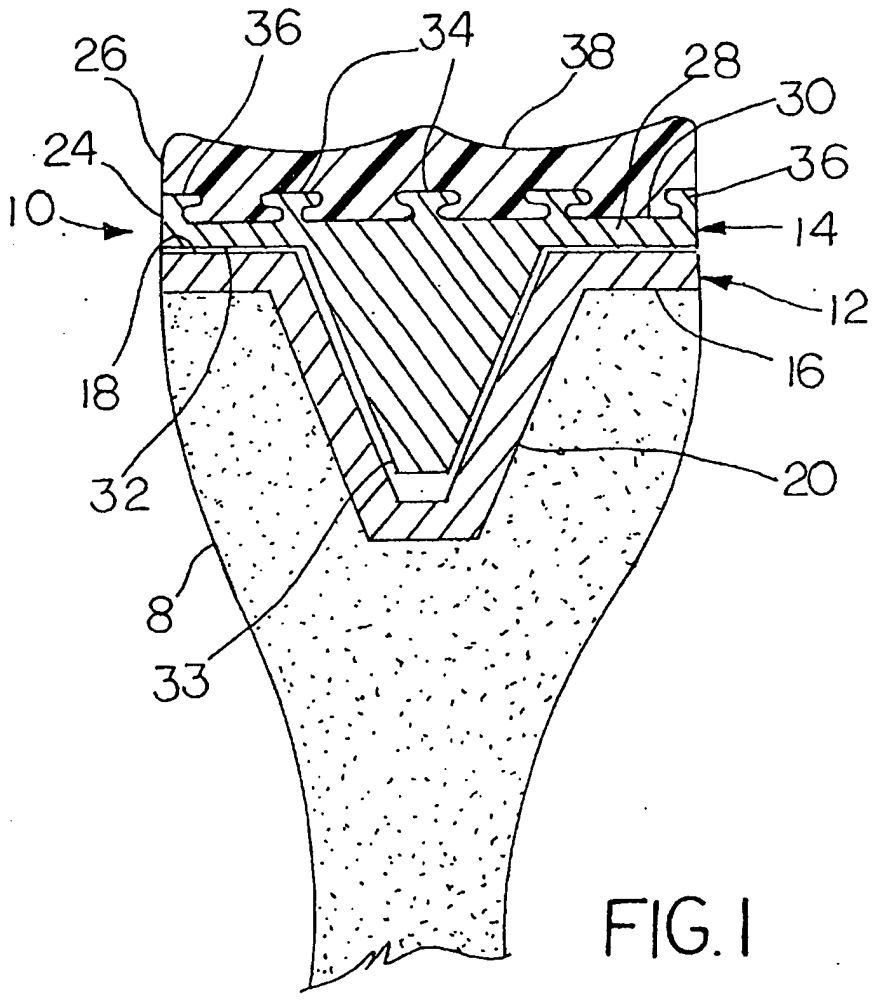

FIG. 1

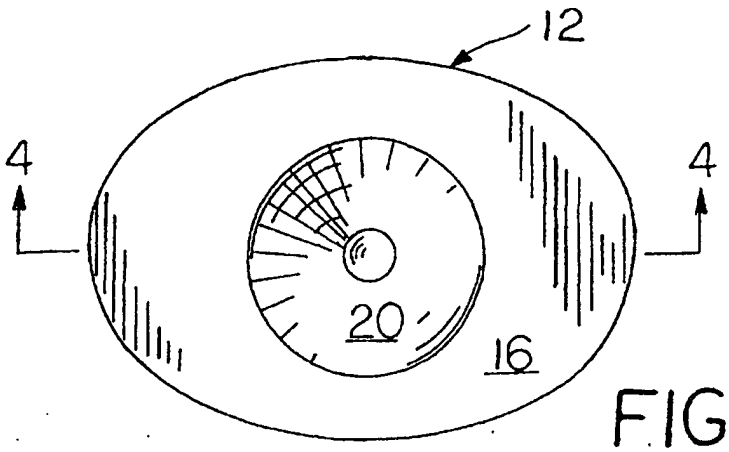

FIG 2.

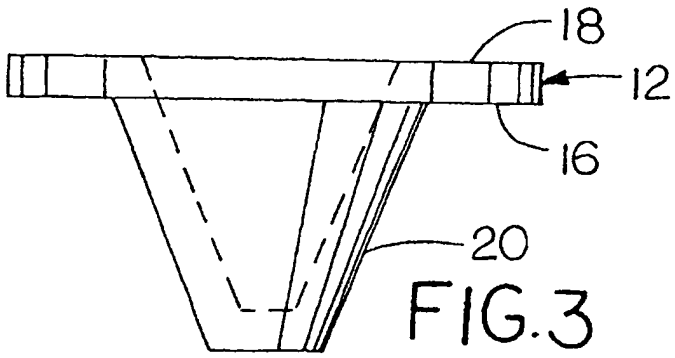

FIG.3

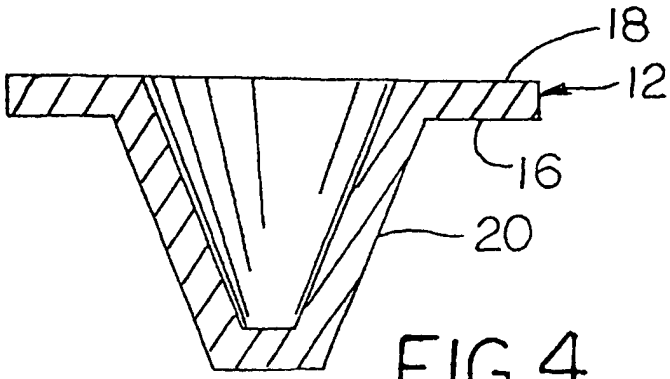

FIG.4

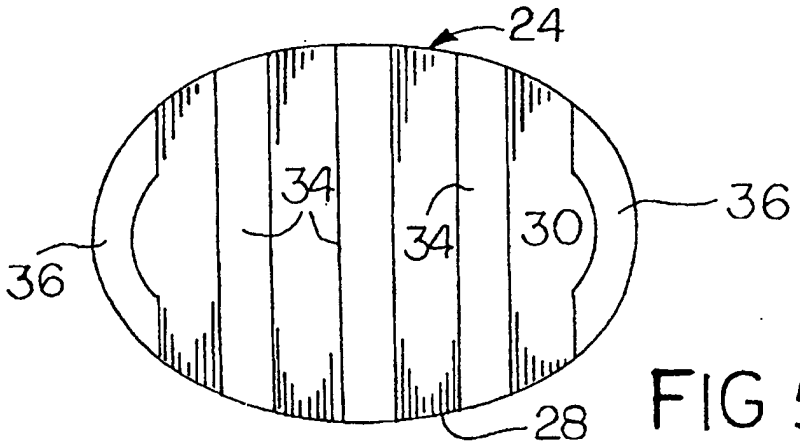

FIG 5

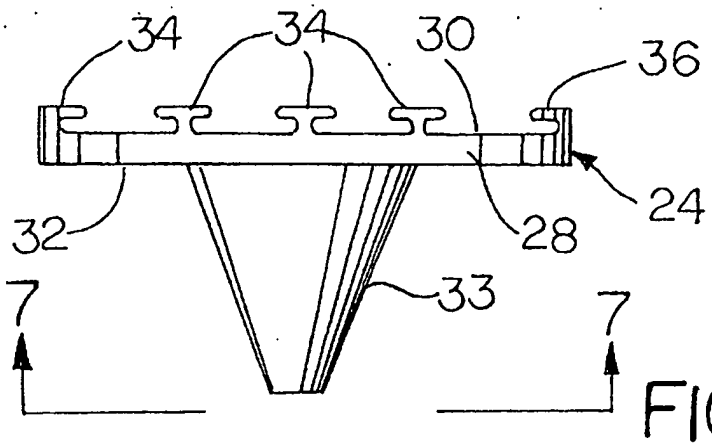

FIG.6

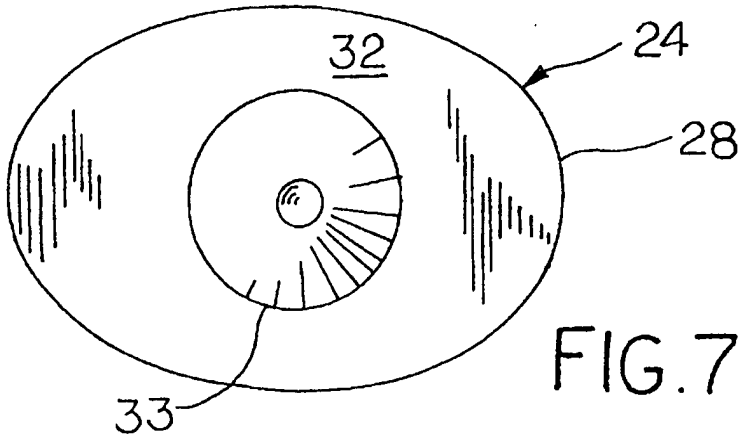

FIG.7